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GB00/2668

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Dated 4th September, 2000.

14JUL99 E461814-2 D02917
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13 JUL 1999

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# Request for grant of a patent

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference

**1830501/AM**

2. Patent Application Number **9916422.0** 13 JUL 1999

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

**Scientific Generics Limited**
**Harston Mill**
**Harston**
**Cambridgeshire CB2 5NH**

Patents ADP number *(if known)* 5693874002

If the applicant is a corporate body, give the country/state of its incorporation

Country: **ENGLAND**
State:

4. Title of the invention

**OPTICAL CELLULAR COMMUNICATION**

5. Name of agent **Beresford & Co**

"Address for Service" in the United Kingdom to which all correspondence should be sent

**2/5 WarwickCourt**
**High Holborn**
**London WC1R 5DJ**

Patents ADP number 1826001

6. Priority details

| Country | Priority application number | Date of filing |
|---|---|---|
| | | |

7. If this application is divided or otherwise derived from an earlier UK application give details

Number of earlier of application — Date of filing

8. Is a statement of inventorship and or right to grant of a patent required in support of this request?

**YES**

9. Enter the number of sheets for any of the following items you are filing with this form.

| | |
|---|---|
| Continuation sheets of this form | |
| Description | 3 |
| Claim(s) | |
| Abstract | |
| Drawing(s) | 2 + 2 |

10. If you are also filing any of the following, state how many against each item.

| | |
|---|---|
| Priority documents | |
| Translations of priority documents | |
| Statement of inventorship and right to grant of a patent *(Patents form 7/77)* | 1 + 2 COPIES |
| Request for preliminary examination and search *(Patents Form 9/77)* | |
| Request for Substantive Examination *(Patents Form 10/77)* | |
| Any other documents *(please specify)* | |

11. I/We request the grant of a patent on the basis of this application

Signature Beresford & Co — Date 13 July 1999

BERESFORD & Co

12. Name and daytime telephone number of person to contact in the United Kingdom — ALAN MACDOUGALL

Tel:0171-831-2290

## Optical Cellular Communication

### Background

The applicant has described in WO98/35328 an optical communication system employing a pixellated reflective modulator array combined with a telecentric optical system. The system operates by assigning each user of the system a unique pixel in the array. Each pixel in the array maps to a unique angular position in the field of view of the telecentric optical system (figure 1). The content of WO98/35328 is incorporated herein by reference.

An optical cellular system has been described (reference 1), in which a fixed `transmitter', consisting of an array of vertical cavity surface emitting laser diodes (VCSEL) and beamsteering optics, communicates with a `receiver' consisting of collection optics and an array of photodiodes. The system can be `cellular' in that several transmitter units can be used with tessellating fields of view, and the receiver can receive signals from more than one transmitter. The receiver can therefore select which transmitter is giving the highest signal strength.

A disadvantage of the system described in reference 1 is that data can only flow from transmitter to receiver. Our invention concerns a method by which duplex operation can be achieved in an optical cellular system.

## Description of the Invention

According to our invention, the 'base unit' part of the system (equivalent to the 'transmitter' of reference 1) comprises a Quantum Confined Stark Effect (QCSE) modulator array and telecentric optical system as described in WO98/35328. The 'mobile' part of the system (equivalent to the 'receiver' of reference 1) is described below.

According to the first aspect of our invention, the mobile unit comprises a VCSEL array and a photodiode array (figure 2). The VCSEL array and the photodiode array are matched in that there is a one-to-one correspondence between individual devices in each array. This can be achieved by ensuring that the dimensions of the two arrays are matched, although similar functionality could be achieved using optical magnification. Light is split in an efficient manner between VCSEL array and photodiode array using polarisation sensitive optics as shown. In operation, the system functions as follows:

Initially, communication must be established between base and mobile units. As can be seen in figure 2, for any relative position of base and mobile units, the telecentric optical system ensures that an individual device in the mobile unit VCSEL array is imaged onto an individual device in the base unit's QCSE array. At system start up, the mobile unit would transmit a coded identification signal by applying this signal to all elements of the VCSEL array. This signal would be received by one element of the base unit's QCSE array shown in figure 2. The base unit is therefore able to assign that QCSE element to the exclusive use of the mobile unit. Next, by employing that element of the QCSE array as a modulator, an identification signal may be retro-reflected to the mobile unit. This signal is detected by a single element of the mobile's photodiode array. In this way, the mobile is able to assign an individual photodiode, and corresponding VCSEL to the base unit. It will be appreciated that further mobile units within the base unit's field of view could establish similar link with different elements of the base unit's QCSE array, and similarly, each mobile unit could establish link to other base units within its field of view. This enables the base to mobile link with the highest signal strength to be selected for communication. It also allows communication to be maintained if a link is broken (for example, by interruption of the beam) since the next highest signal link can then be selected for communication.

When the mobile unit wishes to transmit data to the base unit, it applies modulation to the VCSEL element corresponding to the base unit position. When the mobile unit wishes to receive data from the base unit, it switches the VCSEL element corresponding to that base unit on in continuous wave (CW) mode. The light from this VCSEL element is imaged onto the corresponding QCSE modulator. The QSCE modulator imparts data onto the light, which is retro-reflected to the mobile unit, and

is focussed onto the corresponding photodiode element. Thus, duplex operation can be achieved.

In the second aspect of our invention, we employ a QCSE array in the mobile unit (figure 3). This array can be configured as shown to form a pixellated light source. Light from a laser diode is expanded and collimated, and is used to illuminate the QCSE modulator via a beam splitter. Each element of the QCSE modulator array reflects or absorbs a part of the incident light in accordance with the electrical bias applied to that element. Operation of the system is then identical to that described in the first aspect of our invention.

In both aspects of our invention, the mobile unit is able to move with respect to the base unit. The system is able to sense this movement, as signals will move from one element of the base unit's QSCE array to an adjacent element, and hence elements at both ends of the links may be continuously re-assigned to maintain the communication link.

## References

1. `A Cellular Optical Wireless System Demonstrator', F Parand et al, Engineering Science Department, Oxford University, presented at IEE Colloquium `Optical Wireless Communications' (99/128) 22 June 1999.

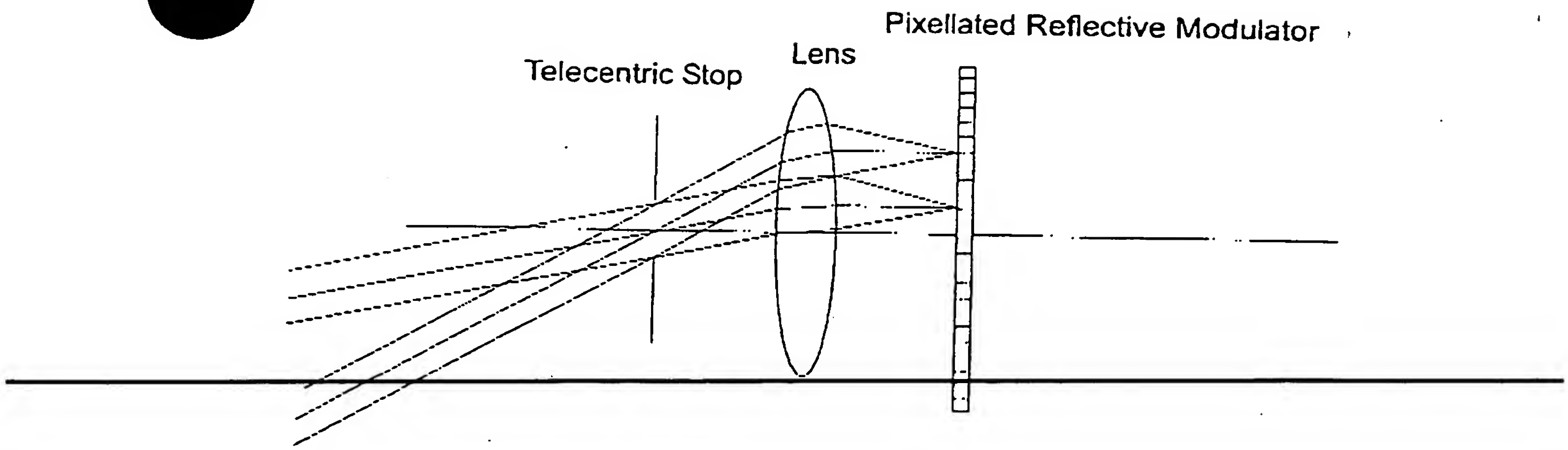


Figure 1

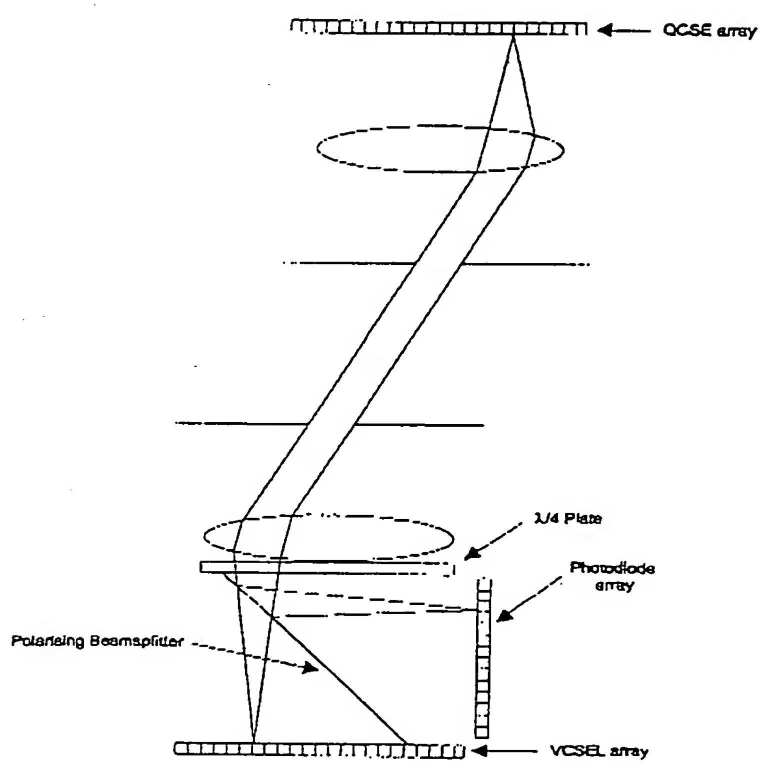


Figure 2

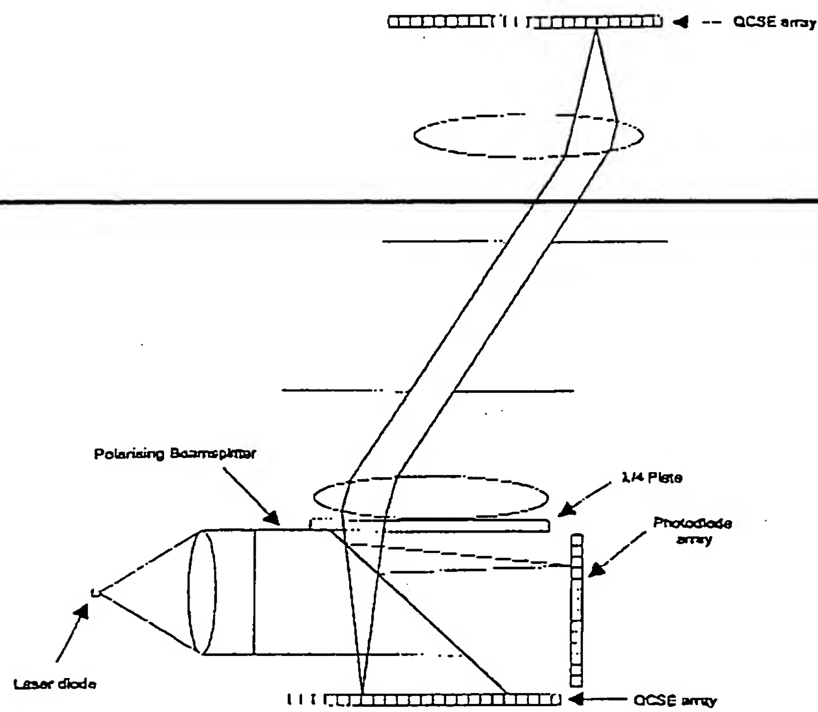
QCSE array
Polarising Beamsplitter
λ/4 Plate
Photodiode array
Laser diode
QCSE array

Figure 3